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ABSTRACT

This paper examines the application of different planning models to the new product development process. Various models are discussed in relation to the four principal stages of the process: product search, project development, market structure analysis, and investment analysis. The authors emphasize that all useful planning models must address a manager's real decision-making problems and must be sufficiently understandable to inspire managerial confidence. And since different firms face different problems, the application of a particular model must be evaluated in light of each firm's specific needs. Throughout the paper, the authors describe a number of planning models that they feel meet these requirements. (JG)

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THE ROLE OF MODELS IN NEW PRODUCT PLANNING

by

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The Role Of Models In New Product Planning

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The Role Of Models In New Product Planning

New-product planning requires a continual monitoring of the social and scientific environments to discover new needs and means to satisfy them. A firm's capabilities in these areas show up in how well it is able to guide research and development efforts, an acquisition and mergers activity, and the general search conducted for improved ways to serve its customers and provide for profitable growth. Unless a firm is willing to consider the ultimate outcomes of its activities in terms of consumer benefits, however broadly defined, decision makers cannot provide reasonable allocation of efforts to scientific, social, and product development programs. The demands for information for these activities are high and much of the information required is, by its nature, imprecise and difficult to quantify.

The activities that occur in new product planning must necessarily provide the information links between the economic and technical capabilities of a firm and the aesthetic, social and economic perceptions of the consumer's world. Occupying this key position, it is useful to consider the role of model building and analytical techniques in the management of information for new product planning.

The four principal areas of information management activities that will be considered here are: (1) the search process that affects the rate and character of new product proposals: (2) the screening process that affects the modifications and refinements of a given proposal; (3) the process of analyzing the demand/competitive structure of the market; and (4) the investment analysis process that influences the amount and timing of financial resources committed to a well-defined new product investment proposal. There is no intention to imply that these are

highly discrete activities in firms or that the above order is uniformally observed, but the discussion of the role of models for new product planning as well as consideration of management factors is aided by distinguishing between these activities.

Much of the model building efforts that will be discussed here, such as technological forecasting, market structure analyses and risk analysis, have been developed to improve the collection and communication of information dealing with a variety of economic and technical factors. Improving the coordination and dissemination of information has also been the goal of various proposals for organizing new product planning. Venture teams, new product committees, and business development departments are examples of different attempts to improve the management of information by changing organizational structure. 1/

It is now being recognized that there are important interdependencies between the effective use of models and the way in which new product planning is organized. 2/ This is in contrast to earlier discussions of models which stressed only quantitative decision problems, ignoring the crucial human, organizational elements. Although these elements are not the central focus of this paper, selected research findings on

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1/ Some references that discuss the organizational factors of new product planning from a variety of perspectives are: (1) Richard M. Hill and James D. Hlavacek, "The Venture Team: A New Concept in Marketing Organization," Journal of Marketing, Vol. 36, No. 3 (July, 1972), pp. 44-50; (2) James Hillier, "Venture Activities in the Large Corporation," IEEE Transactions on Engineering Management, Vol. 15, No. 2 (June, 1968), pp. 65-70; and (3) Jay W. Lorsh and Paul R. Lawrence, "Organizing for Product Innovation," Harvard Business Review, Vol. 43, No. 1 (Jan.-Feb., 1965), pp. 109-122.

2/ H. Paul Root, "New Product Investment Decisions: The Process and Procedures," in Combined Proceedings, 1971 Spring and Fall Conferences, Fred C. Allvine, ed. (Chicago: American Marketing Association, 1972), pp. 147-150.

decision making behavior will be noted. In reviewing past model building efforts and projecting directions in model development, our emphasis will be on models that contribute to an entrepreneurial orientation of the organization and improve the new product performance of the firm.

The New Product Planning Process

New Product Planning and Information Management

The new product development process involves many persons and groups in a firm. These entities usually have their own interests to protect and their own pet projects to promote. Ritti and Goldner's remarks about research and development management accurately describe the organizational context: "Decisions' are in fact, negotiated settlements in the form of a current operating plan or target shaped through a process of approximation and bargaining."[3/] To be effective, the negotiations must be based on appropriate information such as economic and technical facts, estimates and predictions about the external and internal environment. Most formal phases of new product development are concerned with gathering and analyzing these types of data.

It should be emphasized that there is nothing inherently wrong with the process simply because it is a political one. There are, in fact, good reasons for maintaining many of the political elements. In this climate, however, it is important to recognize that a successful new product program requires people who have the desire, the imagination, and the courage to move a project from the idea stage to the market place. These product champions provide the entrepreneurial leadership required during the early years of the product's life.

3/ R. R. Ritti and Fred H. Goldner, "Professional Pluralism in An Organization," Management Science, Vol. 16, No. 4 (December, 1969) p. 244.

Decision Elements of the Process

From the point of view of the individuals responsible for an organization's new product planning, the process begins with an actionable new-product proposal. Although a proposal is the result of prior creative activity, unless the conceptual work is reduced to an actionable proposal, it is irrelevant in the current context. Therefore, the first step in the process concerns the wide range of activities which can efficiently produce a stream of desirable proposals. Those include such diverse functions as monitoring the market structure and competitive moves, seeking merger and acquisition possibilities, conducting research and development, and observing basic trends in buyer behavior. All of these activities consume resources and can be managed to yield a more productive stream of opportunities.

Regardless of source, a proposal is rarely born in a mature form permitting full assessment of the opportunity it will represent at the time of terminal decision. Much of what immediately follows can be classified as preliminary scenario development and screening. Typically modest commitments to information collection and/or development efforts are called for until a formal budgetary decision has been made, typically as a written description and request for funds. During this gestation period, prior to moving the proposal out of the initiating organization, the scenario becomes more detailed, perhaps being accompanied by a preliminary activity network and budget.

Once the proposal and budget have been approved, work on developing the product and its associated production and marketing plans can move ahead. The alternative forms these elements will take may not be well-defined, but the work has been structured. Now, it is essentially a question of how to do something more than discovering what to do. Strong

time dependence among the tasks is frequently observed. Production may not be able to determine unit costs until after the alternative designs have been complete, preliminary design work may depend on both engineering studies and consumer research, and marketing programs must await the availability of pilot plant output for use testing.

During this whole process, information collection, project redefinition and rescheduling, and economic analysis are important elements. Ultimately, if the proposed product has not passed into oblivion or been shelved for the foreseeable future, it must enter the market. Prior to this decision some extended economic analysis is called for to determine whether test marketing or related programs are called for. In general, these information forays are designed to further define programs and the risk of commitment to a full-scale introduction. When information collection becomes a subject for decision making, it is common to find that several competing or complimentary methods are available. This may be true during the development stage as well as during the test-market, introductory stages. From search to final market introduction, a complex set of information and analysis activities must be consciously organized and managed. They cover a wide range of techniques and the whole spectrum of new-product activities.[4/]

Search Policy

Managing the factors that influence the way in which new product ideas will be proposed and evaluated in a firm is the most important aspect of the new product planning process. What happens here will

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[4/] For a more complete discussion of this process see: (1) Edgar A. Pessemier, New-Product Decisions: An Analytical Approach (New York: McGraw-Hill Book Company, 1966); and (2) James M. Utterback, "The Process of Technological Innovation Within the Firm," Academy of Management Journal, Vol. XIV (March, 1971).

affect all that follows in product development. Long range planning, technological and environmental forecasting, and research and development project selection are some of the activities that play key roles in this process and that have received the attention of model builders. Designing organizational and personal incentive programs for fostering creativity and entrepreneurship, and improving communications between customers and bench scientists have also been the subject of studies. The problem the manager faces is that of utilizing the results of these two areas of research to examine and improve the situation in his own firm.

Technological Forecasting Models

A significant ingredient of any attempt to direct a company's search process is a projection of potential scientific and technical advances and the products they can spawn. Given the rate of change in almost all scientific fields and the consequent difficulty for managers to remain knowledgeable about the changes, there has been a large number of methods developed under the general heading of technological or environmental forecasting. No attempt will be made to review these developments,[5] but several important approaches deserve mention; trend extrapolation of key product parameters,[6] Delphi procedures that rely upon pooling information and forecasts made by experts in a particular scientific

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[5] The Harvard Business Review and Business Horizons have published a series of articles on this subject. More technical articles have appeared in Technological Forecasting. Many methods and applications are discussed in Technological Forecasting for Industry and Government, James R. Bright, ed., (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968).

[6] James L. Barr and Kenneth E. Knight, "Technological Change and Learning in the Computing Industry," Management Science, Vol. 14 No. 11 (July, 1968), pp. 661-681.

field,[7] and extensions of technological forecasting to product planning such as TRW's PROBE[8] and Honeywell's PATTERN procedures.[9] The basic motivation behind these developments is the desire to base forecast on applicable historical data and expert opinion, and make the forecasting procedures explicit and readily communicable.[10]

The Role of Technological Forecasting

Managers concerned about the role of technological forecasting methodologies in improving the search process must integrate the outputs of the forecasts into the planning process. This means that the results must be meaningful in a product/market strategy sense, but more importantly in a time horizon sense. An excellent discussion of the problems of the time horizon are the series of interviews with executive leaders in Cordtz's Fortune article.[11] The ways in which companies such as American Standard, Bell & Howell, 3M, RCA, Texas Instruments and Xerox attempt to balance the time horizon for research and development projects are discussed. The article by Boettinger,[12] assistant

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[7] Olaf Helmer, Social Technology, (New York: Basic Books, 1966).

[8] Harper Q. North and Donald L. Pyke, "'Probes' on the Technological Future," Harvard Business Review, Vol. 47, No. 3 (May-June, 1969), pp. 68-82.

[9] Laurence D. McGlauchlin, "Long-range Technical Planning," Harvard Business Review, Vol. 46, No. 4 (July-Aug., 1968), pp. 54-64.

[10] Joseph P. Martino, "Technological Forecasting: But Haven't I Been Doing That All Along?" The Futurist, Vol. VI, No. 3 (June, 1972).

[11] Don Cordtz, "Bringing the Laboratories Down to Earth," Fortune, Vol. 83, No. 1 (Jan., 1971).

[12] Henry M. Boettinger, "Technology in the Manager's Future," Harvard Business Review, Vol. 48, No. 6 (Nov. - Dec., 1970).

controller of American Telephone and Telegraph, points out some of the organizational problems faced by managers in seeking to maintain a balance between short run and long run technological developments. The problems that General Electric faced when trying to develop a strategy for pursuing several areas of technological development further illustrate the management problems.[13]

Since the problems faced by firms, such as planning horizons, are different, then the models for the search process, such as technological forecasting, must be evaluated on the specific needs of a firm. Pessemier has described a simulation approach to evaluating technological forecasts and search policies for product areas that are not highly contingent on new scientific knowledge or radical market changes.[14] By this procedure it is possible to estimate the economic outcomes of various research and development programs when various criteria are used to evaluate proposals. In a similar manner, it is possible to appraise the value of improving the accuracy of forecasts of the products' economic performance or of changing search policies and criteria used to judge the worth of product proposals.

The Project Development Process

Once a proposal, no matter how informal, has entered the system, it needs to be evaluated before disappearing or before further resources are committed to the proposed new product idea. The key decision activities are oriented to sharpening and examining the worth of the proposal at each of the various funding steps. The many alternatives

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[13] Allan T. Demaree, "G.E.'s Costly Ventures Into the Future," Fortune, Vol. 82, No. 4 (October, 1970).

[14] Edgar A. Pessemier, "Financial Planning and Control of Industrial Research and Development," Long Range Planning, (December, 1970).

that exist need to be examined from all points of view such as market appeal, engineering feasibility, production costs and investment requirements. Developing an organization which can handle diverse interests and designing procedures for processing subjective data involve a wide range of practical, behavioral and information handling problems.

Two of the most widely used modeling approaches to the information management activities in the development process are scoring models and network models. Both of these techniques are concerned with assisting managers in spotting problems that may arise during the development process. Although scoring models have not been effective in comparing one project against another, the discussion of the use of scoring models in Corning Glass Works[15] illustrates the contributions of these models in communicating key factors among a diverse group of judges. Network models such as PERT have been extended to assist in the monitoring of the early stages of product introduction and test marketing.[16] The important application of network models is that specific responsibilities are clarified by the necessity for assigning estimated time schedules and resource requirements for product developments.

One of the important management tasks in the refinement of a project as it moves through various funding levels is the necessity to find vital flaws early and to spot opportunities for improving the product.

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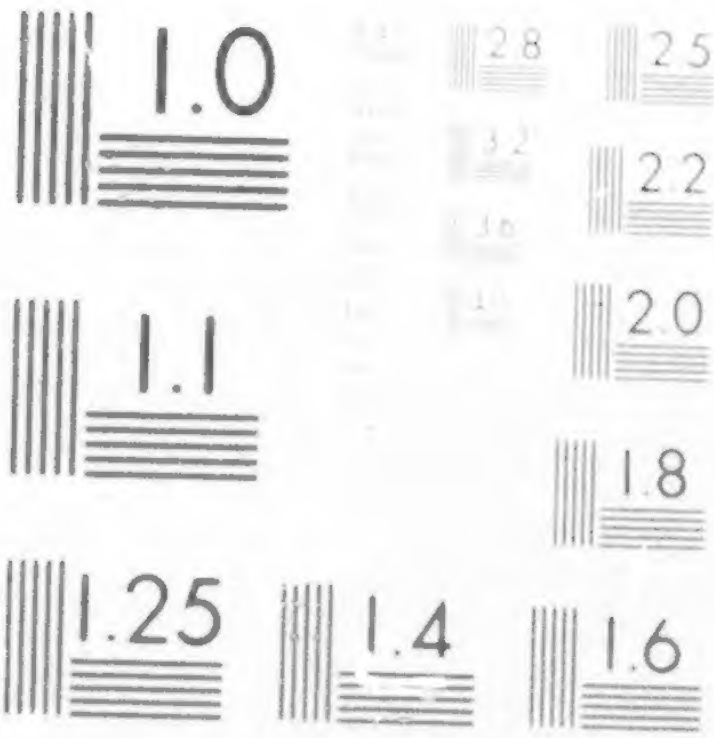
[15] John C. Chambers, Satinder K. Mullick and David A. Goodman, "Catalytic Agent for Effective Planning," Harvard Business Review, Vol. 49, No. 1 (Jan.-Feb., 1971), pp. 110-119.

[16] Arnold R. Saitow, "CSPC: Reporting Project Progress to the Top," Harvard Business Review, Vol. 47, No. 1 (Jan.-Feb., 1969) and Peter P. Schoderbek and Lester A. Digman, "Third Generation PERT/LOB," Harvard Business Review, Vol. 45, No. 5 (Sept.-Oct., 1967).


1.0
2.8
2.5
3.2
2.2
3.6
2.0
1.1
1.8
1.25
1.4
1.6

Models that can help minimize these assessment problems include some of the more recent advances in market structure analyses.[17] These types of models, which can also be useful in the search process,[18] develop joint space configurations based on consumers' perceptions of the properties or attributes of existing and potential new products. The capacity to handle new and existing products and relate attributes of products to preferences are particularly useful when evaluating alternative product design features and in communicating consumer preferences to engineers and scientists.

Market Structure Analysis

As noted above, the continuing analysis of the demand/competitive characteristics of the market is an on-going activity cutting across all phases of new product planning. A novel method of market analysis which uses an attribute based discriminant configuration of the type discussed by Massy[19] and Johnson[20] and the Carroll-Chang joint-space PREFMAP

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[17] Volney J. Stefflre, "Market Structure Studies: New Products For Old Markets and New Markets (Foreign) For Old Markets," in Application of the Sciences in Marketing, Bass, King, and Pessemier, eds., (New York: John Wiley, 1968), pp. 251-268.

[18] Alan D. Shocker, Dennis Gensch, and Leonard S. Simon, "Toward the Improvement of New Product Search and Screening," in Marketing Involvement in Society and the Economy, P. R. McDonald, ed., (Chicago: American Marketing Association, 1969), pp. 168-175).

[19] William F. Massy, "Analyzing Product Profiles with Orthogonal Discriminant Functions," Proceeds of National Meeting of Business and Economics Section, American Statistical Association, 1966, pp. 141-151.

[20] Richard M. Johnson, "Multiple Discriminant Analysis: Applications to Marketing Research," (Chicago: Market Facts, Inc., Jan., 1970).

program[21] has been described by Pessemier.[22] The method involves two distinct phases prior to the joint-space analysis. First, market segments are developed on the basis of relative brand preference (predicted relative frequency of brand purchase.) Second, a geometric spacial representation of brands is developed by discriminant analysis from judged levels of each brand's affective attributes (like sportiness, durability or comfort). These two types of data are used as input to PREFMAP. Analytical results for a simplified disguised problem will illustrate the utility of this extended form of market structure analysis.

Table 1 shows the way consumers judged each of eight frequently consumed brands (B1-B8) on the eight properties or attributes (A1-A8). For example, brand 1 is judged to be high on attribute 1 and brand 7 is judged to be low on the same attribute. Table 2 shows how the typical consumer in each of the five selected market segments (S1-S5) differ in terms of their preferences or expected relative frequency of purchase for the brands. For example, members of Segment 5 are very prone to choose brands B1 and B5. Clearly, these data are valuable by themselves since they indicate how typical consumer types vary in preference and how these consumers judge the valued attributes of the brands under study. It is more interesting, however, to perform the joint-space analysis that combines Table 1 and 2 type data and extends these results

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[21] J. Douglas Carroll, "Individual Differences and Multidimensional Scaling," in R. N. Shepard, A. K. Romney, and S. Nerlove," Multidimensional Scaling: Theory and Applications in the Behavioral Sciences, (New York: Seminar Press, 1972), pp. 105-155.

[22] Edgar A. Pessemier, "A Measurement and Composition Model for Individual Choice Among Social Alternative," Institute Paper #348, Krannert Graduate School, Purdue University, April/August, 1972.

TABLE 1

SIMPLE ANALYSIS OF BRAND ATTRIBUTES

Brand Attributes*	Brand Attribute Levels (Scored 1 -6) Brand Names B1	B2	B3	B4	B5	B6	B7	B8
A1	.78	.42	-.66	-.39	.51	.24	-.68	-.23
A2	1.84	1.14	-1.72	-.96	1.71	.78	-2.05	-.74
A3	.70	.16	-.18	-.26	.84	-.02	-.32	-.92
A4	.46	.83	-.87	-.21	.40	.46	-.99	-.09
A5	1.78	1.03	-1.19	-1.23	1.44	.03	-1.02	-.84
A6	.40	.50	-.64	-.10	.31	.05	-.54	.03
A7	.86	.99	-1.23	-.56	.93	.71	-1.10	-.61
A8	.62	-.62	.62	-.62	.62	-.62	.62	-.62

*All attribute univariate F levels significant at .0005

TABLE 2

MARKET SEGMENTS DEFINED BY "EXPECTED RELATIVE FREQUENCY" OF BRAND PURCHASE

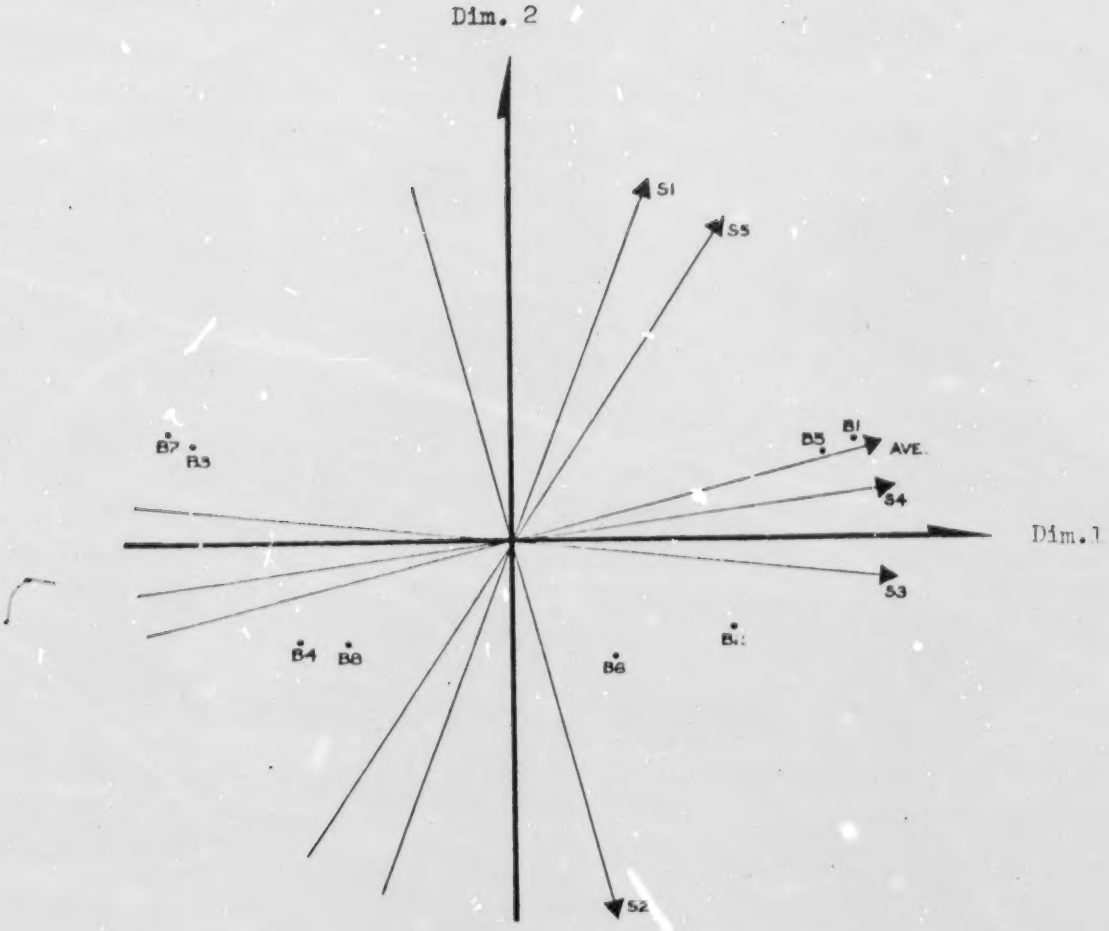
Market Segment*	"Expected Relative Frequency" of Brand Purchase by Segment Brand Names B1	B2	B3	B4	B5	B6	B7	B8	Total
S1	.18	.12	.13	.09	.18	.09	.17	.04	1.00
S2	.08	.28	.05	.13	.05	.20	.02	.19	1.00
S3	.22	.18	.03	.07	.20	.13	.04	.14	1.00
S4	.21	.22	.04	.07	.22	.18	.06	.02	1.00
S5	.32	.13	.05	.04	.28	.08	.05	.05	1.00

*Ratio of residual within group to total variance achieved by a five group segmentation, .53.

to determine how attribute levels are associated with brand preferences. Figure 1 shows the location of brands and the orientation of the market segments' preference vectors. The dimensions or axis of the space are defined in terms of the brands attributes and the vectors represent the orientation of the brand preference of segments in terms of these same dimensions. Table 3 and 4 indicate some of the numerical relationships, providing a clear presentation of the analytical information of greatest use in new product design on product promotional positioning.

As Table 3 indicates, an attribute interpretation of the configuration is obtained from the squared "loadings" of the brand attribute ratings on the dimensions (or discriminant factors) of the space. Clearly, some attributes make much larger contributions to affective discrimination than do other attributes. In addition, the simple loadings may also be used to estimate the properties of any new brand an analyst may want to locate in the space. On the other hand, if the attribute ratings are known for a new product, its point in space may be located with the aid of the discriminant function. In either case, the method is direct with the appropriate coefficients for the linear estimating equations coming directly from the discriminant analysis.

Turning to Table 4 and the analysis of preference, a new set of variables are provided by PREFMAP that show the degree to which each dimension of the discriminant configuration contribute to the determination of each segment's preference for the brands under investigation. Note that Dimension 2 has become more important in "explaining" preference than it was in "explaining" affective discrimination. Also the importance of the two dimensions in explaining preference varies



Fit of Preference Vectors In Discriminant Joint Space

Segment	r	F
S1	.93	15.4
S2	.94	20.7
S3	.94	20.7
S4	.94	19.0
S5	.99	38.2
Average	.99	216.6

$F_{.01} = 13.3$

Market Segments S1 - S5

Brands B1 - B8

Discriminant Configuration
% Variation Explained by
Dim. 1 80.5
Dim. 2 16.8

Sig. of Conf.: $F_{.0005} = 1.7$

$F_{computed} = 96.0$

Figure 1. A Joint Space Analysis Based on a Discriminant Analysis of Brand Attribute Ratings and Metric Brand Preference Judgments

TABLE 3

ATTRIBUTE ANALYSIS OF THE JOINT SPACE CONFIGURATION

Brand Attributes	Brand Attributes Association With Dimensions of Space: "Explained" Discrimination - (Squared Loadings) Dim. 1	Dim. 2	"Unexplained" Discrimination (1-Communalities)
A1	.327	.001	.672
A2	.898	.009	.093
A3	.161	.094	.745
A4	.235	.093	.672
A5	.741	.055	.204
A6	.170	.037	.793
A7	.459	.027	.514
A8	.000	.627	.373
"Total Explained"	2.991	.943	4.066
"% Explained"	.374	.118	.508

TABLE 4

PREFERENCE ANALYSIS OF THE JOINT SPACE CONFIGURATION

Market Segment	Fit PREF MAP r	Association of Market Segments' Preferences (Est. Purchase Probabilities) With Dimensions of Joint Space: "Explained" Probability of Brand Purchase (Squared Correlations) Dim. 1	Dim. 2	"Communalities"
S1	.93	.02	.98	1.0
S2	.94	.01	.99	1.0
S3	.94	.99	.01	1.0
S4	.94	.99	.01	1.0
S5	.97	.30	.70	1.0
Average	.99	.96	.04	
"Total Explained" *		2.30	2.70	5.0
"% Explained"		.46	.54	1.0

* Average Segment Omitted

dramatically from market segment to market segment. Again, it is an easy matter to estimate the brand by brand competitive effect of inserting a new brand in the space or moving an existing brand. Although the above discussion is necessarily brief, it makes three central points related to new product programs:

(1) A market structure can be generated and searched for new product opportunities.

(2) New brands can be positioned for competitive advantage and described in terms of their attributes and competitve effect. The above analytical capabilities are especially useful in the design and conceptualization phase of new product development.

(3) This form of joint-space analysis can be used effectively to examine the potential performance of alternative new product entries or possibly modified existing entries. Here, the question is less one of design than it is one of choosing among alternatives.

The Investment Analysis Process

As a new product venture takes shape, it becomes more amenable to formal economic analysis. During the early part of the development process, investment demands remain small and most expenditures are made to improve the proposal by reducing technical, market and cost uncertainties. As the time approaches in which a firm may be required to make a major financial commitment for the full scale introduction of the product, analysis of a more detailed formal nature can generally be justified.

The models which have been developed to aid in generating measures of effectiveness such as distributions of discounted present values or return on investment will be reviewed in this section. Most of these models can be used to guide product development activities because they

are concerned with the costs and benefits of additional information for the product proposal.

Models by Charnes, et.al.,[23] Hertz,[24] and Urban[25] yield a distribution of outcomes and/or a formal procedure for examining the desirability of a given method or sequence of collecting for the information. Although these models differ in their reliance analytical solutions rather than a Monte Carlo simulation, the basic concepts of the risk analysis approach can be illustrated by the model developed by Pessemier[26] and extended by Root.[27]

The starting point in the analysis is the formulation of alternative marketing and investment strategies. Each strategy can be defined over the planning cycle for the new product in terms of the five basic variables of unit price, unit sales, capital investment, annual fixed costs and unit costs that depend on production configuration and level of operation.

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[23] A Charnes, W. W. Cooper, J. K. DeVoe, D. B. Learner, "DEMON: A Management Model for Marketing New Products," California Management Review, Vol. XI, No. 1 (Fall, 1968), pp. 31-46.

[24] David B. Hertz, "Risk Analysis in Capital Investment," Harvard Business Review, Vol. 42, No. 1 (Jan.-Feb., 1964), and "Investment Policies That Pay Off," Harvard Business Review, Vol. 46, No. 1 (Jan.-Feb., 1968).

[25] Glen L. Urban, "A New Product Analysis and Decision Model," Management Science, Vol. 14, No. 8 (April, 1968), pp. B490-517.

[26] Edgar A. Pessemier, "New Product Ventures," Business Horizons, Vol. XI, No. 4 (August, 1968), pp. 5-19; and same references as footnote 4, pages 141-167.

[27] H. Paul Root, "Implementation of Risk Analysis Models for the Management of Product Innovations," in Computer Simulation Versus Analytical Solutions for Business and Economic Models, Walter Goldberg, (Gothenburg, Sweden: University of Gothenburg, August, 1972), pp. 93-127.

All basic variables are estimated in terms of .1 and .9 deciles and a measure of central tendency. Other information required include estimated annual marketing expenditures, costs as a per cent of dollar sales, tax and depreciation data and discount rates. The market and cost related variables can be estimated separately for a variety of product lines and/or market segments.

If the project is analyzed early in the development stage, the program input also includes estimates of the probability of success in the development, the distribution of time to success or failure and the annual cost of research and development. With these data, the economic characteristics of the entire venture may be measured including the research and development phases. The input requirements can be greatly reduced by substituting expected values for all basic variables and simplifying a wide range of other inputs. Although this approach forecloses the uncertainty analysis, it may be useful early in a proposal's development to quickly screen alternatives.

The output of the model provides a wide variety of information for the evaluation of a new product line being analyzed. Some of the more important financial summary information are listed in Table 3. Clearly, the information available, particularly when combined with the ease of doing sensitivity analysis, can be produced in enough detail to satisfy managerial needs.

The evolution of this particular analysis program illustrates one of the important managerial aspects of the use of models. In evaluating a new product investment proposal, there is no single measure that is used, but rather multiple criteria are needed. For example, Figure 2 illustrates a typical comparison of two alternative pricing strategies.

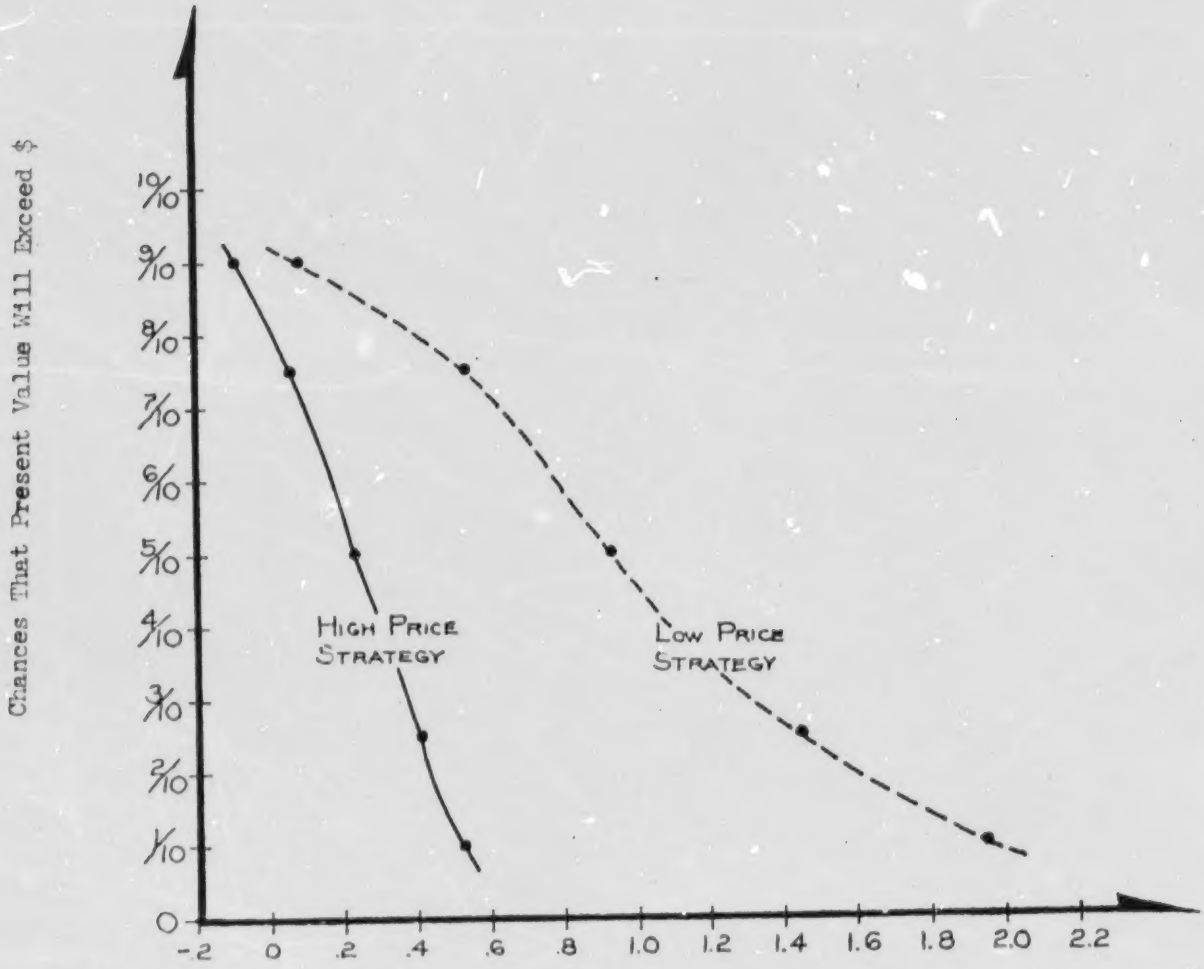

FIGURE 2 Present Value Risk Profiles

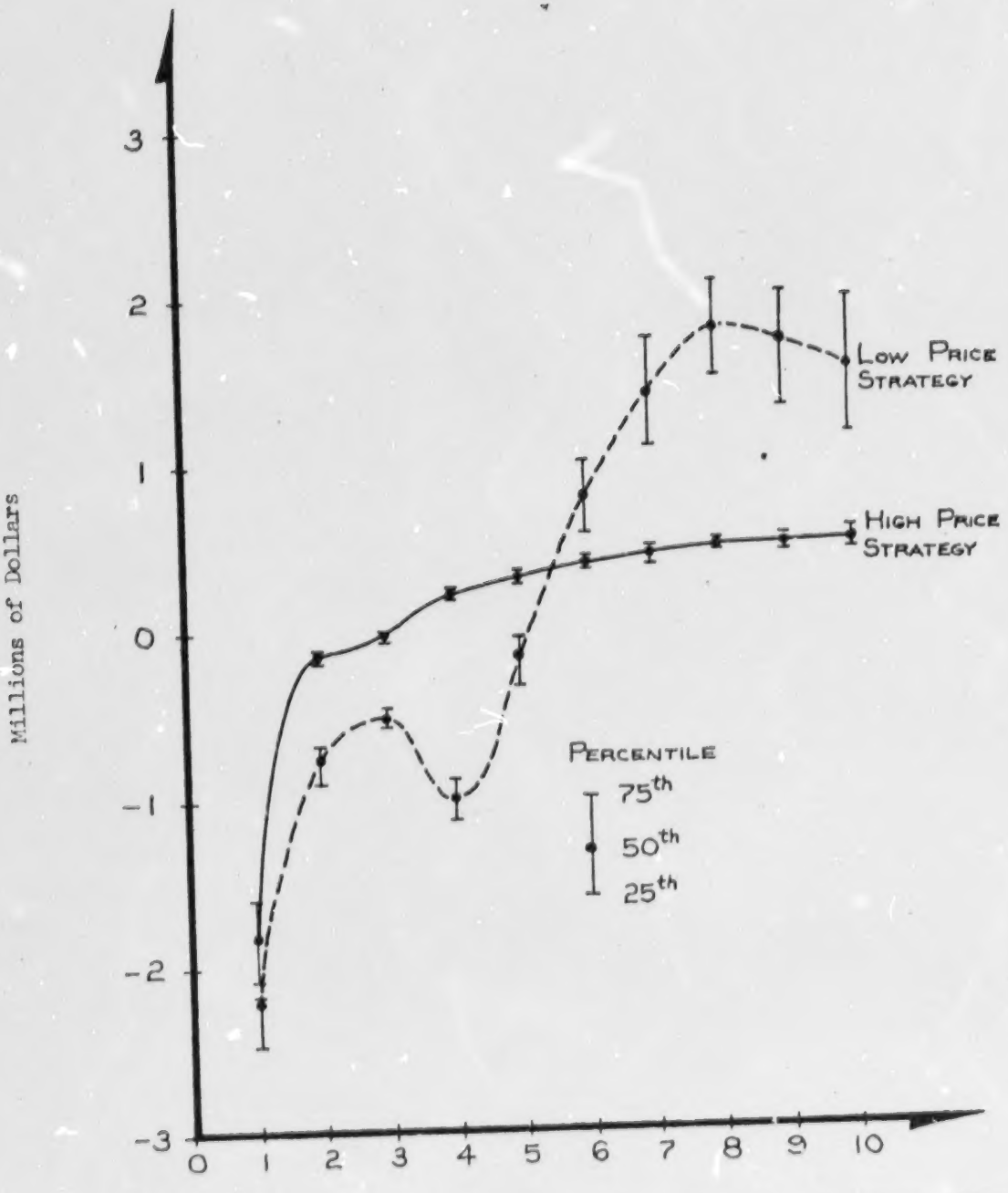

FIGURE 3 Yearly Cash Flow Profiles

TABLE 3

FINANCIAL SUMMARY INFORMATION AVAILABLE
FROM PESSEMIER--ROOT MODEL

Profit Contribution By Each of Several Product Lines
Sales By Product Type--Dollars and Per Cent of Total Sales
Sales Lost Due to Capacity Limitation
Value of Unutilized Plant Capacity
Annual Profit as Per Cent of Sales
Annual Dollars Sales--Probability Distribution
Annual Profits After Taxes--Probability Distribution
Annual Net Cash Flows--Probability Distribution
Cumulative Dollars Sales--Probability Distribution
Cumulative Cash Flows--Probability Distribution
Return on Investment--Probability Distribution
Present Value--Probability Distribution

Using risk/return criteria based on present value, the low price strategy would be the preferred one. However, when the annual cash flows are examined, as illustrated in Figure 3, the selection of the alternatives is not as straight forward. The heavy, extended financial commitments of the corporation under the low price strategy must be considered in relation to the smaller, shorter commitments associated with the high priced strategy.

The point being emphasized is that the use of models in the new product investment process can easily provide the extensive information that managers effectively appraise and refine alternative investment opportunities. The use of expanded financial criteria also changes the amount of input information and the way in which it is organized. In this role, models change the way decisions are made. It is in sharp contrast to early modeling efforts that tended to use existing data and take advantage of computing speed to automate existing procedures.

The increasing number of published materials [28] on the use of risk analysis models supports the point that models can have a positive benefit on the political and social process that occurs in new product development, potentially supporting the firm's entrepreneurship.

Summary

Applications of planning models to the new product process have been briefly examined in relation to the four principal stages of the process. Emphasis has been placed on two requirements of good planning models; that they address the manager's real decision problems in the context of his organization and that they are sufficiently understandable to ensure managerial confidence in the applications. It seems likely that a growing number of improved models will meet these requirements and an increasing proportion of the managers responsible for new-product activities will want to enhance their decision-making effectiveness by skillfully using these powerful tools.

The associated information activities designed to collect and evaluate data about the firm's market environment and its capacity to respond are also likely to assume increased importance within the firm's product planning function.

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[28] Some articles that discuss the use and effects of risk analysis models rather than only the technique include: (1) John H.C. Braden, "A Systems Approach to the Introduction of a New Product," The Business Quarterly, Vol. 36, No. 3(Autumn, 1971); (2) Eugene E. Carter, "What Are the Risks in Risk Analysis?" Harvard Business Review, Vol. 50, No. 4 (July-Aug., 1972); (3) Paul Maguire, "Capital Investment Simulation Models--Current Practices," unpublished MBA thesis, New York University, 1972; H. Paul Root, "The Use of Subjective Probability Estimates in the Analysis of New Products," in Marketing Involvement in Society and the Economy, P.R. McDonald, ed., (Chicago: American Marketing Association, 1969); and (5) A.E. Stuenkel and R.J. Gillespie, "Results and Methods in the Risk Oriented Decision," paper presented at the 34th National Meeting of the Operations Research Society of America, Philadelphia, Pa., November 8, 1968.

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